

A NEW SPECIES OF *UPEROLEIA* (ANURA: LEPTODACTYLIDAE) FROM THE PILBARA REGION, WESTERN AUSTRALIA

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Summary

DAVIES, M., MAHONEY, M. & ROBERTS, J. D. (1985) A new species of *Uperoleia* (Anura: Leptodactylidae) from the Pilbara Region, Western Australia. *Trans. R. Soc. S. Aust.* **109**(3), 103-108, 29 November, 1985.

Uperoleia glandulosa sp. nov., is described from the Pilbara region of Western Australia. The new species is sympatric with *U. russelli*. Call information and karyotype are included in the species description.

KEY WORDS: *Uperoleia glandulosa* sp. nov., advertisement calls, Anura, Leptodactylidae, karyotype.

Introduction

In revising the genus *Uperoleia* Gray, Tyler, Davies & Martin (1981a) restricted the distribution of the nominate species *U. marmorata* Gray to the type locality "Western Australia", estimated from Gray's journals to be in the Prince Regent River area. Later they recorded the distribution of *U. mjobergi* (Andersson) as confined to the Fitzroy River drainage (Tyler *et al.* 1981b). Hence records of *U. marmorata* and unsubstantiated records of *U. mjobergi* (as *Glauertia mjobergi*) in the Pilbara region of Western Australia (Main 1965; Main & Storr 1966) cannot be sustained.

A third species, *U. russelli* (Loveridge) is recorded from the Pilbara and is considered endemic to the region (Main 1965; Main & Storr 1966; Tyler *et al.* 1981a; Tyler, Smith & Johnstone 1984).

During field work following Tropical Cyclone Jane in January 1983, two of us (J.D.R. and M.M.) collected two species of *Uperoleia* near Port Hedland. One of these species is *U. russelli* and the other is conspecific with the specimen referred to by Main (1965) and Main & Storr (1966) as *U. marmorata* and which is undescribed.

Here we describe the new species and include brief notes on its breeding biology, call and karyotype.

Materials and Methods

Material cited here is deposited in the Australian Museum, Sydney (AM), the South Australian Museum, Adelaide (SAM) and the Western Australian Museum, Perth (WAM).

Measurements of specimens follow Tyler *et al.* (1981a). Measurements taken (in mm) were: eye diameter (E); eye to naris distance (E-N); internarial

span (IN); snout to vent length (S-V) and tibia length (TL).

Osteological data were obtained from cleared and alizarin red S stained specimens prepared after the method of Davis & Gore (1947). Osteological descriptions follow Trueb (1979).

Calls were recorded in the field on a Sony TC-510-2 reel to reel tape recorder, with Beyer M101 or AKG D190 microphones at a tape speed of 19 cm s⁻¹. Six call parameters were analysed in detail: (1) mean call period (seconds) estimated from the time taken to make 20 calls (time taken with a stop watch, half-speed playback); (2) call duration; (3) pulse duration; (4) pulse period; (averaged over the whole call) (2-4, all in milliseconds and measured from oscillograms made on a San-ei 5M28 direct recording oscillograph); (5) pulse number (counted oscillograms); and (6) dominant frequency, averaged over five calls by a Tektronix 5L4N spectrum analyser. For the first five parameters, we analysed five calls from each recorded frog. Pulse durations were estimated from all pulses in the call. Periods rather than repetition rates are reported as these are the basic units measured; repetition rates represent a derived unit (Gaioni & Evans 1984). Repetition rates are a simple reciprocal function of periods. Data for each frog were averaged and the mean values were used to calculate an overall mean. Each individual thus contributes one datum point to the final figures.

Mitotic chromosomes were examined from WAM R89489, using the technique described by Mahony & Robinson (1980). Silver staining was carried out following the procedure of Bloom & Goodpasture (1976).

Uperoleia glandulosa sp. nov.

FIGS 1-7

Uperoleia marmorata Main 1965, *Frogs of South Western Australia*, p. 36 (part); Main & Storr, 1966, *W. Aust. Nat.* **10**, p. 57; Cogger, 1983, p. 84.

Holotype: WAM R89489, an adult male collected

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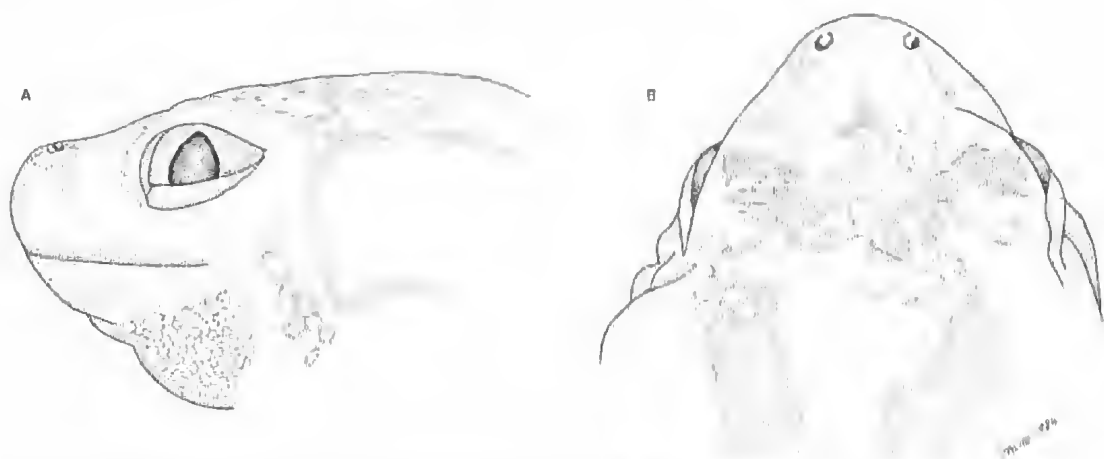


Fig. 1. A lateral, B dorsal view of head of *Uperoleia glandulosa* sp. nov. (SAM R27081).

at Petermarer Creek, Port Hedland-Broome Rd, W.A. (21°23'6"S, 118°48'21"E), on 10.i.1983 by M. Mahoney and J. D. Roberts.

Definition: A moderate sized species (males 20–25 mm, female 25 mm S-V) with moderately long limbs (TL/S-V 0.34–0.41). Maxillary teeth absent; frontoparietal fontanelle widely exposed; basal webbing between the toes; toes fringed; mating call a sharp click.

Description of holotype: Maxillary teeth absent. Vomerine teeth absent. Snout short, truncated when viewed from above and in profile. Eye to naris distance greater than internarial span (E-N/IN 1.36). Canthus rostralis prominent and straight (Fig. 1A). Loreal region sloping. Tympanum not visible externally (Fig. 1B). Fingers moderately long, slightly fringed (Fig. 2A) with well developed sub-articular tubercles. In order of length $3 > 4 > 2 > 1$. Palmar tubercles large and prominent. Supernumerary palmar tubercles prominent. Hind limbs long (TL/S-V 0.37). Toes long, fringed, with basal webbing (Fig. 2B). In order of length $4 > 3 > 5 > 2 > 1$. Large oval inner and broad outer metatarsal tubercles. Subarticular tubercles conical.

Dorsal surface with well defined parotoid, inguinal and coccygeal glands (Fig. 3). Dorsum faintly tubercular. Submandibular gland disrupted. Ventral surface finely granular.

Male with unilobular, submandibular vocal sac. In preservative, dorsal surface brown. Short cream, midvertebral stripe on anterior 1/3 of body. Black, lyrate markings on scapular region (Fig. 3) and black patches on other portions of dorsum.

Surfaces of parotoid, inguinal and coccygeal glands, cream. Inguinal and femoral regions cream. Ventral surface cream with chocolate brown suffusions. Submandibular region dark brown.

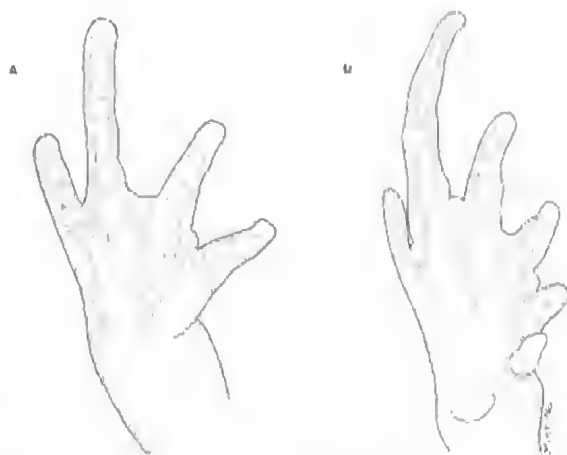


Fig. 2. A palmar view of hand, B plantar view of foot of *Uperoleia glandulosa* sp. nov. (SAM R27081).

Colour in life. Main & Storr (1966) described the colour of WAM R22921 as "Dorsal ground colour olive-brown with black spots and blotches. Anteriorly an indistinct vertebral series of orange spots. Dorso-laterally a broken orange stripe from behind orbit nearly to groin. A small orange spot on each side of sacrum. A large orange red blotch in groin and on outer surface of thigh. Upper surface of limbs as on dorsum. Ventrally whitish flecked with grey. Lower surface of limbs flesh-coloured."

This description conforms with our observations. **Dimensions** (in mm): Snout-vent length 20.2; tibia length 7.4; eye diameter 2.8; eye-naris distance 1.9; internarial span 1.4.

Variation: There are seven paratypes, six adult ♂♂ and one adult ♀, WAM R89490-2, AM R114573,



Fig. 3. *Uperoleia glandulosa* sp. nov. in life.

collected with the holotype; SAM R27081, SAM R27082 (cleared and stained), 3.2 km NE Wittenoom turnoff on Port Hedland-Broome Rd, 10.i.1983, M. Mahony, J. D. Roberts. WAM R22921, Mundabullangana (5 km E of Hstd), 19.ii.1961, G. M. Storr.

Males range 19.9–23.4 mm and the female is 24.6 mm S-V. All paratypes are squat with long legs (TL/S-V 0.38–0.41) in the males: 0.34 for the female). E-N/IN ranges 1.13–1.50. All specimens have well developed cream glands, and basal to slightly more than basal toe webbing. Skin texture resembles that of the holotype. The ground colour of the dorsum of the female is grey rather than brown whilst the darker colour markings of all the paratypes are brown whereas the holotype is black. One paratype has a truncated snout when viewed

from above, as in the holotype, whereas the others have more rounded snouts (Fig. 1B). In some of the paratypes the midvertebral stripe is not as conspicuous as in the holotype. Palmar tubercles are not always as prominent as figured.

Mating call structure: The advertisement call of this species is a sharp click: a single note formed by two or three pulses. The pulses have a rapid rise time, one or two oscillations, and an irregular decay to about 1/4 of the peak amplitude before the next pulse is initiated. Pulse periods are short (about 6 ms) and equal to pulse durations. Details of call structure are given in Table 1. An oscillogram is presented in Fig. 4.

Breeding biology: Most males were observed calling around a roadside drainage channel. Males were calling at the base of sedge clumps close to the

TABLE 1. Details of call structure of two *Uperoleia glandulosa* sp. nov. Values are means with standard deviation and range in brackets.

Temperature T°C	Pulse Number	Pulse Duration (ms)	Pulses sec ⁻¹	Call Duration (ms)	Call period (s)	Calls min ⁻¹	Frequency (Hz)
25 (Air dry)	2.3 (0.4, 2.0–2.6)	6.3 (0.8, 5.7–6.8)	160	14.2 (0.6, 13.4–14.6)	0.74 (0.08, .69–.8)	81.1	2875 (35, 2850–2900)

water's edge or in a similar position actually in the water. Males with a similar call were also heard in the Petermarer Creek and around a flooded claypan about 3 km southwest of the Turner River on the Northwest Coastal Highway, in the Turner River but



Fig. 4. Oscillographs of advertisement call of *Uperoleia glandulosa* sp. nov.

not on the Yule River. Males were calling on the third night after two days and two nights of heavy rains (114 mm at Port Hedland).

Uperoleia russelli was calling at the same sites. **Osteology:** Skull poorly ossified, sloping anteroventrally. Small portion of sphenethmoid ossified posteriorly to medial extremities of palatines with ossified portion extending about 1/3 of the length of the orbit in ventral view. Medial ossification of sphenethmoid absent dorsally and ventrally. Prootic not fused with exoccipital. Exoccipital not ossified either dorso- or ventro-medially. Crista parotica short, stocky, not overlain by otic ramus of squamosal. Carotid canal groove not developed on frontoparietals. Frontoparietal fontanelle extensively exposed, overlapped laterally by frontoparietal elements extending narrowly for 9/10 length of orbit. Anterior margin of fontanelle formed by sphenethmoid and medial cartilaginous elements, at level of anterior ramus of pterygoid. Posterior margin formed by articulating postero-medial extremities of frontoparietals (Fig. 5A).

Nasals moderately ossified, approximately triangular with maxillary processes directed more ventrally than laterally; widely separated medially. Maxillary processes not in bony contact with well developed preorbital processes of very shallow pars facialis of maxillary.

Palatines robust, reduced laterally, abutting and just overlying anterior extremities of sphenethmoid ventrally. Parasphenoid robust, cultriform process elongate, extending anteriorly to ossified portion of sphenethmoid in ventral view (Fig. 5B). Alary processes expanded laterally, at right angles to

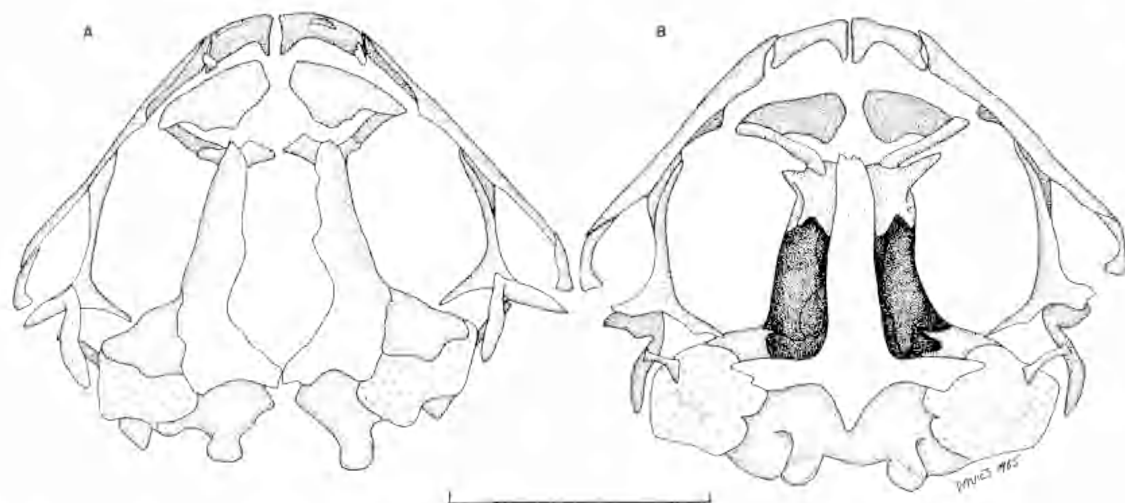


Fig. 5. A dorsal, B ventral view of skull of *Uperoleia glandulosa* sp. nov. (SAM R27082). Scale bar = 5 mm.

cultriform process extending almost to level of anterior extremities of medial rami of pterygoids.

Medial ramus of pterygoid moderately long, acuminate, not in bony contact with prootic region. Posterior ramus moderately long and broad. Anterior ramus in long contact with moderately developed pterygoid process of palatal shelf of maxillary. Cartilaginous quadratojugal present between base of squamosal and quadratojugal. Quadratojugal robust, in firm contact with maxillary.

Squamosal shaft robust; tiny zygomatic ramus, elongate unexpanded otic ramus lying alongside lateral extremities of crista parotica.

Maxillary and premaxillary edentate. Palatal shelf moderately deep with well developed palatine processes not abutting medially, and moderately developed pterygoid processes. Alary processes of premaxillaries moderately broad, bifurcate and perpendicular. Vomers absent. Columella bony.

Pectoral girdle arciferal and robust. Omosternum and xiphisternum present. Sternum cartilaginous. Clavicles slender, curved, poorly separated medially. Scapula bicapitate; about same length as clavicles. Suprascapula about $\frac{1}{2}$ ossified.

Eight non-imbricate presacral vertebrae. Sacral diapophyses poorly expanded. Relative widths of transverse processes III > sacrum > IV > II > V = VI > VII = VIII.

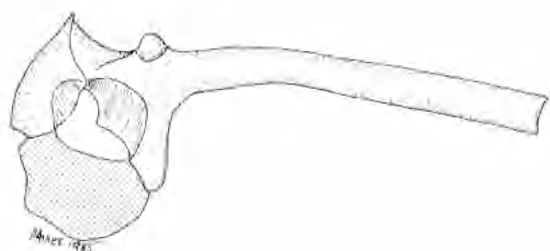


Fig. 6. Lateral view of pelvic girdle of *Uperoleia glandulosa* sp. nov. (SAM R27082).

Bicondylar, sacrococcygeal articulation, Urostyle with crest extending $\frac{3}{5}$ its length. Ilii extend anteriorly to sacrum. Iliac crest absent. Large papillate, dorsal protuberance on small dorsal prominence (Fig. 6). Humerus with strongly developed anteroproximal crest. Phalangeal formula of hand 2,2,3,3. Distal tips of terminal phalanges knobbed. Small bony prepollex and palmar sesamoid. Phalangeal formula of foot 2,2,3,4,3. Well developed bony prehallux.

Karyotype: The karyotype of *Uperoleia glandulosa* is shown in Fig. 7; the diploid number is $2n = 24$. The chromosomes are arranged in two groups on the basis of size. Pairs 1 to 6 are large with relative lengths (R.L.) ranging from 15% to 9%; pairs 7 to 12 are small with R.L. ranging from 6% to 2%. Chromosome pairs 3, 4, 5 and 8 are submetacentric, with the remaining chromosomes being metacentric. A prominent secondary constriction which is silver stain positive, and thus considered to be the nucleolar organiser region, occurs subterminally on the short arm of chromosome 4. A distinctive secondary constriction mid-way along the short arm of chromosome 8 was not strongly silver positive and is not considered to be a nucleolar organiser region.

Etymology: The specific epithet is from the Latin *glandula* in reference to the prominent parotoid, inguinal and coccygeal glands in this species.

Comparison with other species. *Uperoleia glandulosa* is distinguished from many congeners by the presence of a widely exposed frontoparietal fontanelle. This feature is shared by *U. arenicola*, *U. borealis*, *U. inundata*, *U. orientalis*, *U. russelli* and *U. talpa*. All of these species, except for *U. orientalis* for which the data are not known, are "long call" species whereas *U. glandulosa* has a very short call. *U. glandulosa* has a stronger back pattern and less extensive webbing than *U. orientalis*.

From the three "short call" species in Western Australia, *U. lithomoda*, *U. minima*, and *U. aspera*, *U.*

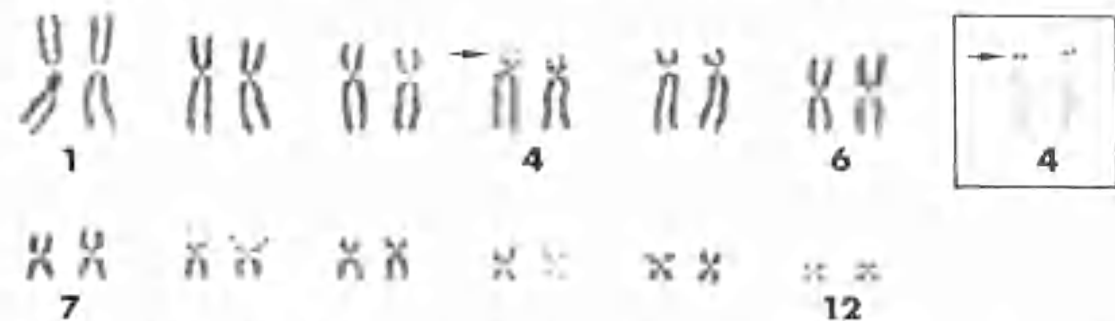


Fig. 7. Karyotype of *Uperoleia glandulosa* sp. nov. Arrows indicate the location of the nucleolar organiser region of chromosome 4; inset shows this region with silver staining. The location of a secondary constriction on chromosome 8 is not silver positive and is indicated by an arrowhead.

glandulosa is distinguished by its greater toe webbing and greater frontoparietal fontanelle exposure.

Discussion

It would appear that the new species that we describe here has been encountered previously at Mundabullangana but misidentified as *U. marmorata* by Main (1965) and Main & Storr (1966). These authors also questioned the identity of some of the material that they assigned to *U. russelli* (as *Glauertia russelli*), considering that it might represent *U. mjobergi*.

No material is available to confirm the existence of a third species in the Pilbara, but during the course of the fieldwork by M.M. and J.D.R., it was thought that a third call type was detected. Hence, although we can now establish that two species are present in the Pilbara (*U. glandulosa* and *U. russelli*), further field work is required to establish if a third species is present.

Although the diploid number, $2n = 24$, of several species of *Uperoleia* has been reported (see Morescalchi, 1979 for a summary), to date no karyotype has been figured and chromosome mor-

phology has not been described for any species of the genus. Karyotypic examination of 10 species of *Uperoleia* (Mahony & Robinson in press), revealed a striking conservatism of chromosome morphology and, in particular, location of the nucleolar organiser region. While this conservatism means that species of *Uperoleia* cannot be distinguished from one another chromosomally, the consistent location of the nucleolar organiser region is a distinctive feature of the karyotypes of *Uperoleia* species, enabling them to be distinguished from all other myobatrachine genera.

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References

- BLOOM, S. E. & GOODPASTURE, C. (1976) An improved technique for selective silver staining at nucleolar organiser regions in human chromosomes. *Hum. Genet.* **34**, 199-206.
- COGGER, H. G. (1983) Reptiles and Amphibians of Australia. 3rd Edn. (Reed: Sydney).
- DAVIS, D. D. & GORE, V. R. (1947) Clearing and staining skeletons of small vertebrates. *Fieldiana Tech.* **4**, 1-16.
- GAIONI, S. J. & EVANS, C. S. (1984) The use of rate of period to describe temporally patterned stimuli. *Anim. Behav.* **32**, 940-941.
- MAHONY, M. J. & ROBINSON, E. S. (1980) Polyploidy in the Australian leptodactylid frog genus *Neobatrachus*. *Chromosoma (Berl.)* **81**, 199-212.
- & — (in press) Nucleolar organiser region (NOR) location in karyotypes of Australian ground frogs (family Myobatrachidae). *Genetica*.
- MAIN, A. R. (1965) Frogs of Southern Western Australia. (Western Australian Naturalists Club: Perth).
- & STORR, G. M. (1966) Range extensions and notes on the biology of frogs from the Pilbara region, Western Australia. *West. Aust. Nat.* **10**, 53-61.
- MORESCALCHI, A. (1979) New developments in vertebrate cytotaxonomy. I. Cytotaxonomy of the amphibians. *Genetica* **50**, 179-193.
- TRUEB, L. (1979) Leptodactylid frogs of the genus *Telmatobius* in Ecuador with the description of a new species. *Copeia* 1979(3), 714-733.
- TYLER, M. J., DAVIES, M. & MARTIN, A. A. (1981a) Australian frogs of the leptodactylid genus *Uperoleia* Gray. *Aust. J. Zool. Suppl. Ser.* **79**, 1-64.
- , — & — (1981b) New and rediscovered species of frogs from the Derby-Broome area, Western Australia. *Rec. West. Aust. Mus.* **9**(2), 147-172.
- , SMITH, L. A. & JOHNSTONE, R. E. (1984) "Frogs of Western Australia" (W.A. Museum: Perth).